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behave in exactly the same manner, whether or not the myodome is present. The prootics meet at the median line above the parasphenoid and form the floor of the brain cavity or myodome, as the case may be, or they end at the outer edges of the parasphenoid, the latter forming the floor. Perhaps, when the myodome is present the prootics meet in fewer cases than when it is not, but both conditions of the prootics are common with both conditions of the myodome. (2) In some forms when no myodome appears in the dried skeleton, if a fresh or alcoholic specimen be examined, a sheet of connective tissue may be found separating the eye muscles from the brain cavity. This tissue is attached to the prootics exactly as the bony shelf is, and possibly the ossification of the shelf takes place in it.

If this be so it explains why the myodome is of no more value in classification than it is, as there would be little difference between a connective tissue septum and the same tissue replaced by ossification. How great a proportion of the forms having no myodome have the connective tissue septum I do not know.

Looking at the matter in this light there seems little difficulty in my mind in deciding whether *Clupea* has a myodome. Any cavity between the prootic shelf and the lower symphysis of the prootics, or between the shelf and the parasphenoid, as the case may be, should be regarded as a myodome. I do not see the application of the fact that the parasphenoid is open below in *Clupea*. It is but a difference in degree between the forms where the myodome is open only posteriorly and where it is entirely open below. There are forms with the condition of the opening intermediate between these two extremes. Of course, the fact that the myodome is open below leaves only a single cranial base interpreted literally, but it could not be considered under the head of 'basis cranii single,' as it is the primary floor that is missing.

In examining a large number of fish specimens with these problems in view I also had for consideration two other problems in connection with the myodome, but unrelated to the above.

Vrolik* states that the prootic is not pierced by the facial and trigeminus nerves when the myodome is absent, in the forms he has investigated (*Gadus*, *Silurus* and *Lophius*). I can add my testimony as to the correctness of these conclusions so far as the forms quoted are concerned, but in the following forms, which have no myodome, the prootics are pierced by one or both the fifth and seventh nerves: *Tetraodon*, *Chilomycterus*, *Lycodes*, *Dormitator*, *Opsanus*, *Brosme*, and perhaps all of the family Blenniidae (six genera were examined).

On the other hand, I know of no form having the myodome well developed, which has the prootics unpierced.

The second point I would touch upon is that the dichost (=basisphenoid of Huxley) is always absent when the myodome is. I know of no case where it is at all ossified when the myodome is absent, though there is often a connective tissue septum in this region continued forward as the interocular septum.

Nearly always the dichost is connected with the edge of the prootic shelf, or roof of the myodome, but that the shelf is not necessary to it is shown by *Esox*, where it is attached to the parasphenoid at its lower end and is free above. In this case the prootic shelf does not extend very far forward. This problem should be examined in connection with the connective tissue myodome septum as its ossification is probably of the same sort.

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BOTANICAL NOTES.

LIFE HISTORY OF THE PINES.

LAST October Professor Dr. Margaret C. Ferguson, of Wellesley College, published in the 'Proceedings of the Washington Academy of Sciences' (Vol. VI., pp. 1-202) an important paper entitled 'Contributions to the Knowledge of the Life History of Pinus, with Special Reference to Spermatogenesis, the Development of the Gametophytes and Fertiliza-

* Vrolik, 'Studien über die Verknocherung u. d. Knochen des Schädels d. Teleostei,' *Niederland. Arch. f. Zool.*, Bd. I., 1873.

tion.' She devotes a dozen or so pages to a brief historical sketch and several pages to the methods of collecting, fixing, sectioning and staining which she followed, and then takes up in successive chapters, 'Microsporogenesis,' 'The Male Gametophyte,' 'Macrosporogenesis,' 'The Female Gametophyte,' 'Fertilization and Related Phenomena.' In a short appendix the author has recorded a number of interesting and suggestive abnormal conditions which have been noticed by her and other observers. A full list of papers cited closes the text of this altogether admirable paper. The plates number twenty-four and include 275 well executed figures.

The work upon which the paper was based was begun in the fall of 1897. The discoveries of Hirase, Ikeno and Webber in the fertilization of the gymnosperms made it 'highly desirable that fertilization and the associated phenomena should be worked out for other members of this group by the more modern methods of investigation.' This was the task which Miss Ferguson set for herself, and in this paper she has recorded the results of her investigation of five species of pines (*Pinus strobus*, *P. rigida*, *P. austriaca*, *P. montana uncinata* and *P. resinosa*). Six hundred separate collections of material were made, and more than four thousand slides of serial sections prepared. This large number is necessary since in the pines a period of almost thirteen months elapses from pollination to the actual fertilization, during which many important cytological changes take place.

We have space to note here only a few things brought out in this paper: The author makes a distinction between the microspore (one-celled) and the pollen-grain (several-celled), the former developing into the latter by a series of divisions. In tracing the development of the sperm-nuclei (spermatozoids) Miss Ferguson finds what she suggests may be the vestigial state of the cilia-forming body found in the lower gymnosperms (*Cycas*, *Zamia* and *Ginkgo*). In the development of the macrospore the division of the mother cell is a true tetrad division, so that the macrospore is a true spore. This germinates and by a typic division gives rise to two nuclei which

pass to opposite poles and there divide again and again until thirty-two or more free nuclei are formed before the long winter rest is entered upon. The prothallium is completed and the archegones (one to nine) are formed the next spring. In fertilization the sperm and egg-cell cytoplasm fuse, but the nuclei do not really fuse, but the chromosomes are mingled in the first mitosis.

LIMU.

THIS is the name applied to many species of seaweeds, especially those that are edible, by the native Hawaiians. In a recent number of the 'Publications' of the University of California (Vol. III., No. 3) Professor Dr. Setchell gives the results of the investigations made by him several years ago, with a view to determining the specific identity of the different kinds of limu. Altogether his list includes one hundred and seven names, not, however, representing that many distinct kinds. For many of these he has been able to determine the species used, while in other cases this has not been possible. One is surprised at the considerable number of species of seaweeds which the islanders have found to be edible, although one suspects that many of them would not be relished by us.

A NEW GRASS BOOK.

ALTHOUGH not strictly botanical the little book entitled 'Farm Grasses of the United States,' by Professor Spillman (Orange Judd Co.), is worthy of a brief notice in these columns. In it the author, who as is well known, is the chief of the Division of Agrostology of the United States Department of Agriculture, has brought together a good many facts that are of interest to the farmers of the country, and some also that will interest the general botanist. Thus the map on page 13 showing the relative amounts of wild, salt and marsh grasses annually cut for hay in different parts of the United States will interest every botanist, and so will the chapter on 'The Seed' (V.). So too the botanist will find something of interest in the succeeding chapters (VI. to XIII.) which discuss timothy, the blue-grasses, the millets, two

southern grasses, red-top, orchard grass, brome grass, grasses of minor importance and those for special conditions. The book will be especially useful to farmers.

THE USEFUL PLANTS OF GUAM.

IN a thick pamphlet of about four hundred pages issued by the United States National Herbarium ('Contrib.,' Vol. IX.) William E. Safford tells what is known as to the vegetation of the island of Guam, nearly 145 degrees east of Greenwich, and a little less than 14 degrees north of the equator. It is illustrated by 70 plates mostly from photographs, including one map of the island. It will be very useful to American botanists who wish to know more about the vegetation of this newly acquired territory, as well as those who wish to learn something as to tropical vegetation in general. The chapters relating to the geography, climate, animals and the people are also full of interest for the general reader, as well as the student of science.

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SCIENTIFIC NOTES AND NEWS.

PROFESSOR CHARLES S. MINOT has been re-elected president of the Boston Society of Natural History.

DR. E. F. NICHOLS, professor of physics at Columbia University, has been awarded the Ernest Kempton Adams research fellowship, recently established at Columbia University by Mr. E. D. Adams in memory of his son. Professor Nichols has at present leave of absence and is working at Cambridge University.

ABOUT five hundred physicians of the United States and Canada were present at the dinner given in honor of Dr. William Osler, which was held in New York on May 2. The toastmaster was Dr. James Tyson, of Philadelphia, and the list of speakers and of the toasts to which they responded was: Dr. Osler in Montreal, 'Student and Teacher,' Dr. F. J. Shepherd, of Montreal; Dr. Osler in Philadelphia, 'Teacher and Clinician,' Dr. J. C. Wilson, Philadelphia; Dr. Osler in Baltimore, 'Teacher and Consultant,' Dr. W. H. Welch, of

Baltimore; Dr. Osler, 'The Author and Physician,' Dr. A. Jacobi, of New York City; presentation of 'Cicero de Senectute,' by Dr. S. Weir Mitchell, of Philadelphia. To these speeches Dr. Osler replied.

THE expedition to the Delta of the Colorado river and the Cucupa mountains organized by Dr. D. T. MacDougal, of the New York Botanical Garden, and Mr. E. A. Goldman, of the U. S. Biological Survey, has returned. The river was found in flood, the water reaching the highest level since 1891 and overflowing through various channels into the Salton Basin. Some important geographical details were brought to light and material additions were made to the knowledge of the natural history of the entire region, part of which had never before been visited by collectors.

THE Alexandre de la Roquette gold medal of the French Geographical Society has been awarded to Professor Erich von Drygalski.

THE Société de Topographie de France has awarded a medal to Dr. William Hunter Workman for topographical research among the high peaks and glaciers of the Himalayas.

PROFESSOR LÉON LABBÉ, the eminent French surgeon, has been presented by his former students with a medal struck in his honor by Patey.

THE Senckenberg Scientific Society of Frankfort has awarded its Sömmering prize for the most valuable work of a German investigator in physiology during the last four years to Professor Haberlandt, of Graz, for a work on 'The Sense Organs of Plants for the Perception of Mechanical Stimuli.'

At the annual meeting of the Boston Society of Natural History, on May 3, the first Walker prize, of \$75, was given to Dr. W. B. McCallum, department of botany, University of Chicago; the second, of \$50, to Mr. M. L. Fuller, United States Geological Survey, Washington, D. C. Their respective papers were 'Physiological Analysis of the Phenomena of Regeneration of Plants' and 'Quaternary Correlations around New York and on the Long Island Shore.'